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THE

MICROSCOPICAL BULLETIN

AND

SCIENCE NEWS

A BI-MONTHLY MAGAZINE

EDITED BY

ALBERT S. BARKER

OCTOBER, 1896

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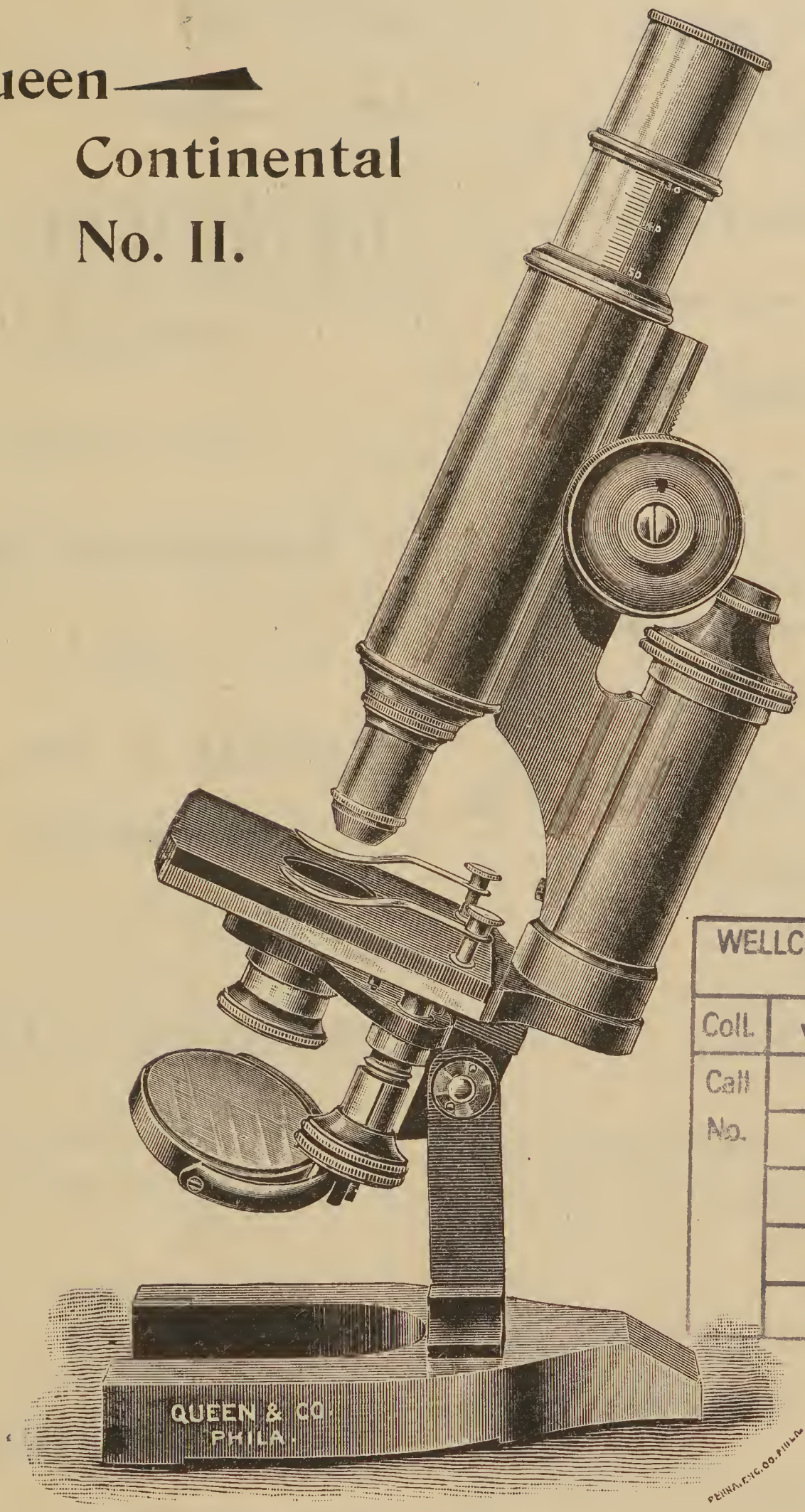

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THE
MICROSCOPICAL BULLETIN
AND
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NOTES AND COMMENTS.

As the time approaches for the reassembling of our national legislators, we again call attention to Senate Bill No. 1552, entitled "A bill for the further prevention of cruelty to animals in the District of Columbia."

This bill has been favorably reported by the committee to whom it was referred, and there is danger of its becoming a law. We have received a copy of the report (Senate No. 1049) and we wish that all of our readers could compare the sentimental and sensational appeals of the advocates of this bill with the dignified though earnest protests of its opponents.

The correspondence between Henry Sewill and Canon Wilberforce is introduced. The Canon had denounced the practice of vivisection using certain epithets to which Sewill objected. Wilberforce defended himself, concluding a very long and warm letter as follows:

"You say the investigators are convinced of the necessity of such experimentation. I reply that an increasing number of intelligent Englishmen, undeterred by what has been well termed (I believe by the late Lord Shaftesbury) 'the insolence of physiological science,' are convinced of the iniquity, the uselessness, and the peril to the human race of such experimentation, and they are determined to do their utmost to render the practice, in this country at least, wholly illegal."

After this, Col. Robert G. Ingersoll is quoted. "Vivisection" says the great orator, "is the inquisition—the Hell—of science. All the cruelty which the human or rather inhuman heart is capable of inflicting, is in this one word. Below this there is no depth. This word lies like a coiled serpent at the bottom of the abyss. * * * The wretches who commit these infamous crimes pretend that they are working for the good of man; that they are actuated by philanthropy, * * * * * * Have these scientific assassins discovered anything of value? * * * I know that all that has been ascertained by vivisection could have been done by the dissection of the dead. I know that all the torture has been useless. All the agony inflicted has simply hardened the hearts of the criminals without enlightening their minds."

"Wretches," "assassins," "criminals." Strong terms!

Mr. Perry, a lawyer, made a speech before the sub-committee, from which we take the following sample:

"You may ask what right I have to assume that these things are being done every day. I have the right to assume it in the highest degree because when we introduce a bill intended to put this thing under control of the law, the Surgeon-General of the Army of the United States comes here to oppose it, and the leading representatives of the medical societies of the District of Columbia come here to oppose it."

Are we to suppose that these leading representatives of the medical societies of the District of Columbia, and the leading representatives of medical societies all over the United States, who also oppose this bill, are the wretches, assassins, and criminals of Mr. Ingersoll's frenzy?

Dr. George M. Sternberg, Surgeon-General of the United States Army, gave the following reasons for objecting to the proposed legislation:

(1) "So far as I know no evidence has been presented to show that unnecessary and cruel experiments upon the lower animals are

being performed in the District of Columbia.

(2) Punishment for cruelty to animals is already provided for by law.

(3) It is an unjust reflection upon those engaged in scientific research work to suppose that they are less humane than other members of the community, and that special legislation is necessary to cause them to administer anæsthetics to animals subjected to painful experiments.

(4) Such legislation would be offensive class legislation, inasmuch as it prescribes the use of anæsthetics in scientific 'experiments,' but fails to provide for the use of anæsthetics in the painful cutting and crushing operations upon male colts, calves, pigs, cats, etc., which are constantly practiced by farmers, veterinary surgeons, and others; and it takes no account of pain inflicted upon the lower animals for sport or for gain.

(5) The progress of scientific medicine has been largely due to experiments upon the lower animals, and the restrictions upon such experiments proposed by this bill would have a very unfavorable effect upon the further development of our knowledge in all departments of biological research."

In his address the Surgeon-General presented many facts in support of his claim that medical science had greatly profited by experiments upon the lower animals, and we commend these words to Ingersoll and others who are inclined to endorse his intemperate and untruthful outburst.

"That those who devote themselves to biological studies are less susceptible to humane sentiments than their fellow men and women, that they inflict unnecessary pain with indifference, or that, as has been charged, they take a cruel pleasure in the sufferings of the helpless victims of their experiments, I believe to be an unfounded calumny based upon ignorance and an excited imagination on the part of those who have arrayed themselves in opposition to experiments on living animals.

As a matter of fact, these experiments have been conducted for the most part by members of the humane profession of medicine in the interest of humanity; and, as already stated, they form the basis of the scientific medicine of the present day."

The Association of American Physicians assembled in annual session at Washington, D. C., May 2nd, 1896, by unanimous vote adopted a resolution protesting against such legislation as that proposed by this bill, and this protest was signed by the officers and members of the Association, including nearly one hundred men of the highest professional standing from all parts of the United States.

Many of our readers will remember the "statement in behalf of science" adopted by a joint committee of thirty-four members of The American Physiological Society, The American Society of Morphologists, The American Anatomical Society, The American Society of Naturalists, The American Society of Physicians and The American Society of Surgeons. "It sets forth the importance of animal experimentation for the advancement of medicine, and may be accepted" says President Eliot, of Harvard University, "as an authoritative expression of expert opinion on this question." We hope that every Senator and every Representative will ponder upon these words with which the statement concludes:

"As to whether or no, under given circumstances of research or teaching, an experiment involving pain should be performed, is a matter which should rest with the responsible expert by whom or under whose direction the thing would be done, otherwise, in a matter involving the interest of the community, those who know would be directed by those who do not know. For any experiment improperly conducted, the person responsible is liable under the general laws against the maltreatment of animals. In fact, American biologists and physicians are no more inclined than other members of the community to culpable negligence toward their fellow-creatures. The work of science goes on; but those who are responsible desire, and see to it, that the work be painless, so far as admissible. No intelligent man or woman should give heed to the denunciations of those few ill-informed or headstrong persons who have been drawn into one of the least wise of the agitations which beset modern society."

These are not the words of assassins; they express the deliberate judgment of a body which in point of character and attainments is second to none in the world, and it is the duty of our representatives to listen to them and to be guided by them.

The authors of this bill beg for its enactment in the name of humanity, and in the name of humanity we ask for its rejection.

* * *

We are very much obliged to the writer of the following note which explains itself:

September 12, 1896.

Editor "MICROSCOPICAL BULLETIN,"
Philadelphia.

DEAR SIR: In the August number of the "MICROSCOPICAL BULLETIN," on page 32, is an excerpt from the "*National Druggist*" giving a formula for Toison's Solution under the heading, "Stain for Red Blood Corpuscles," and as the article is a rather misleading one, I beg to state that this solution is employed for the purpose of diluting the blood in the Thoma-Zeiss capillary tube as a substitute for a 3 per cent. salt solution, or for a 2½ solution of potassium bichromate, and *not* as a stain for the erythrocytes, upon

which it has no effect. Toison's Solution should be made as follows:*

Methyl violet	.025
Neutral glycerin	30.
Distilled water	80.

To this add:

Sodium chloride	1.
Sodium sulphate	8.
Distilled water	80.

Filter.

When made according to the above formula, it is considered by many preferable to the salt and the potassium solutions, for the reason that it causes no alteration in the shape of the red cells, and because by its use the leucocytes are in a few minutes stained blue, and, are therefore, readily distinguished from the unstained red cells in the field of the counting chamber of the hæmocytometer, thus avoiding all confusion that might arise as to the identity of the different cells.

Very truly yours,
J. C. DA COSTA, JR.

* * *

We have received the Thirteenth Annual Announcement of *The Philadelphia Polyclinic*, a book of 53 pages containing lists of the trustees, corporators, faculty, instructors and clinical assistants; general information as to the buildings, equipments, system of instruction, society privileges, etc.; general and special schedules of instruction; a list of the class of 1895, which consisted of graduates of thirty-eight medical schools; and, finally, fourteen full-page photographic views of the laboratories, operative rooms, etc., which will materially aid the text in convincing graduates in medicine that the *Polyclinic* has "facilities for acquiring a practical acquaintance with the clinical aspects of disease and the diagnostic procedures and methods of treatment in general medicine and surgery that were formerly attainable only by those who obtained positions as resident physicians in the larger hospitals."

More than 500 major operations were performed at the Polyclinic Hospital during the past year, of which a great number were abdominal sections, and it is stated that the pupils have the opportunity of seeing probably twice as many more in the private practice of the staff.

We may add that the Polyclinic is located in the centre of a great city which is noted for its solid comforts.

* * *

Messrs. Queen & Co. Inc. have issued a circular announcing the engagement of Mr. Henry Orford to take charge of their new department for the manufacture of high grade objectives.

Mr. Orford acquired his knowledge of theoretical and applied optics in the leading establishments of England and Germany, and has also largely profited by his experience with a famous American house.

On another page we publish an article by Mr. Orford, which indicates that he has a full understanding of the requirements of the delicate business of lens making, and Messrs. Queen and Co. invite critical examination of the product.

Mr. Orford has promised an article on "Aperture and its Effectiveness" for our next number.

* Vide Herrick's "Medical Diagnosis," Philadelphia, 1895.

[For THE MICROSCOPICAL BULLETIN.]

BLOOD STAINING.

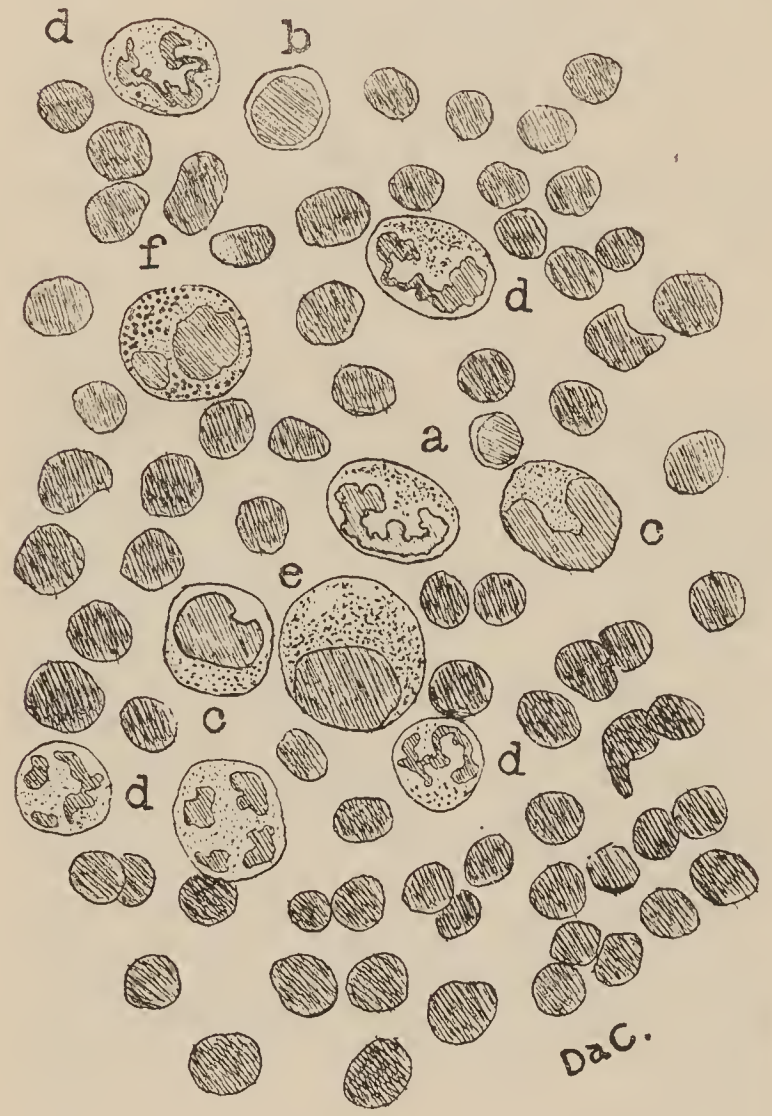
BY J. C. DA COSTA, JR., M. D.
PHILADELPHIA.

Chief of Medical Clinic, St. Agnes' Hospital; Assistant Demonstrator of Clinical Medicine, and of Pathological Histology, Jefferson Medical College.

Blood staining has attained such important development during the last few years, and such a mass of material bearing upon the subject has been accumulated out of which it is difficult to choose the method best suited for one's use, that a brief resumé of the science from a practical standpoint may be of interest. This article, therefore, assumes only to treat of the elements pertaining to this subject, dwelling only upon those topics which are of proven value to the routine worker in hæmatology, and omitting an elaboration of the science, which is to be found in the text-books on medical diagnosis.

The value of blood staining from a diagnostic standpoint is at once apparent, when it is considered that by this means alone can leucocytosis be accurately determined, the different varieties of leukæmia be distinguished, and the presence of certain parasites in the blood be demonstrated. As the condition of leucocytosis depends upon an increase in the polynuclear leucocytes, and as in the unstained blood it is impracticable to differentiate all the various forms of leucocytes, the blood must be stained so that every form will exhibit its characteristics. In a like manner, the varieties of leukæmia, which are due to an alteration in the normal percentage of the leucocytes, and to the presence of leucocytes absent in normal blood, may be readily distinguished. Such micro-organisms as the bacilli of tuberculosis, and streptococci, are visible only in the stained preparation; while the parasites of malarial fever, the spirilla of relapsing fever, and even the bacilli of anthrax, although well shown by staining, may be studied in the fresh, unstained blood. In addition, staining is of value in the identification of the different granules which occur in the

protoplasm of the leucocytes, and which have been assigned by Ehrlich such prominent clinical significance. Of the five different kinds of these granules originally described, but two are of practical value. These are the eosinophilic granules (or "eosinophiles"), which show a peculiar affinity for an acid dye like eosin; and the neutrophilic granules, which are stained by a neutral dye, that is, a combination of an acid and a basic dye. The basophilic granules, a third variety noted by Ehrlich, and stained by a basic dye, are of exceedingly rare occurrence in the blood, and need not be considered.



THE BLOOD IN LEUKÆMIA.

(From a case of Splenic-myelogenic Leukæmia in the Jefferson Medical College Hospital.)

a. Small lymphocyte.
b. Large lymphocyte.
c. Transitional leucocyte.
d. Polynuclear leucocyte.
e. Myelocyte.
f. Eosinophile.

In the study of the leucocytes in the stained specimen, five varieties are found in normal blood, with the addition of a sixth, the myelocyte, in leukæmia. These varieties are as follows:

The small lymphocyte, a cell about the size of the normal erythrocyte, almost completely occupied by a single nucleus.

The large lymphocyte, larger than the small lymphocyte, and largely filled by a single nucleus.

The mononuclear transitional leucocyte, containing a twisted and curved nucleus, and having a large area of protoplasm, which very faintly exhibits neutrophilic granules.

The polynuclear leucocyte, of large size, with an irregularly shaped nucleus, or with several, small nuclei, and distinctly exhibiting neutrophilic granules in its protoplasm.

The eosinophile, a large cell having one or more irregular nuclei, and with protoplasmic granules which are brilliantly stained by an acid dye, such as eosin.

The myelocyte, a large mononuclear cell, showing neutrophilic granules in its protoplasm. It is present in the blood in some forms of leukæmia; and has been observed by v. Jaksch in a case of interstitial nephritis, and by the writer in malarial fever.

The following table, from Herrick's "Medical Diagnosis," shows the varying proportion of the leucocytes in normal blood, and in those conditions in which the relative percentage is altered:

	Normal Blood.	Leucocytosis.	Splenic-Myelogenic Leukæmia.	Lymphatic Leukæmia.
Small lymphocytes.	15-30	4	1	97.9
Large mononuclear lymphocytes and transitional forms.	5+ —	6+ —	6+ —	4
Polynuclear neutrophiles.	75	89	65	1.4
Eosinophiles.	3-5	1	5	.1
Myelocytes.	0	0	23	.0

In the erythrocytes the presence of nuclei, and malarial parasites is well shown by staining. The erythrocytes also undergo, in different diseases of the blood, marked changes from their normal appearance of bi-concave, round-margined discs, a summary of these alterations in their size and shape being given below:

The macrocyte, or bi-concave disc of much larger size than normal.

The microcyte, or bi-concave disc of much smaller size than normal.

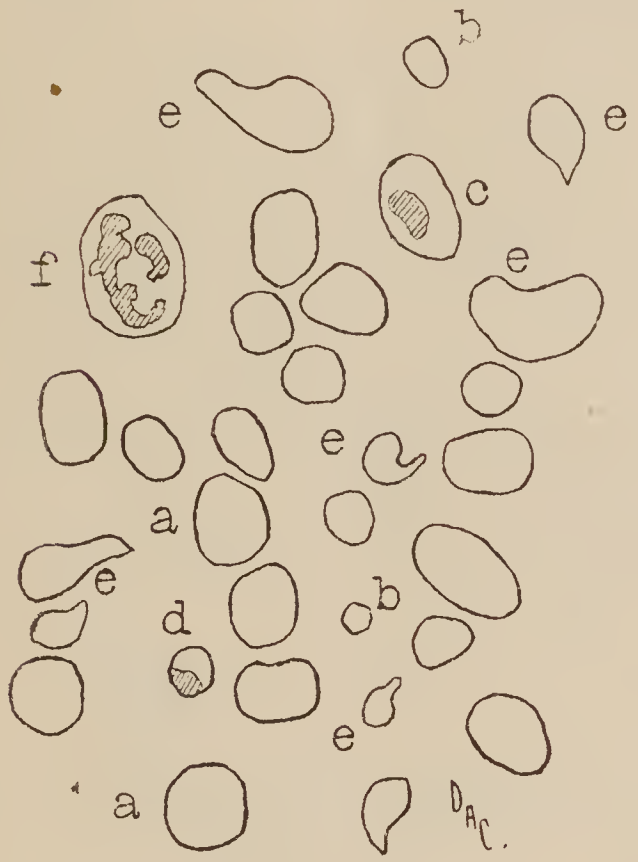
The gigantoblast, a corpuscle of very large size, possessing a distinct nucleus.

The normoblast, a small nucleated corpuscle.

The poikilocyte, a corpuscle exhibiting many bizarre forms in both shape and size, among which the clubbed, kidney-shaped, and spiked varieties are common.

For the examination of the stained specimens a one-twelfth inch oil-immersion ob

jective with a one-inch ocular is required. The instruments needed are few and inexpensive; a puncture needle provided with a guarded spear-point, or, in lieu of this, an ordinary new steel pen, one prong of which has been broken off, will prove satisfactory; a few pairs of Stewart cover-glass forceps, in which the cover-glasses are held while being



THE BLOOD IN PERNICIOUS ANÆMIA.

(From a case of Pernicious Anæmia in the Jefferson Medical College Hospital.)

a. Macrocyte.
b. Microcyte.
c. Gigantoblast.
d. Normoblast.
e. Poikilocyte.
f. Leucocyte.

stained; and a pair of slightly curved, blunt-pointed forceps, used for picking up the cover-glasses. Several glass pipettes, a glass funnel, watch-glasses, and filter paper will also be required. Oblong number two cover-glasses are to be chosen, as they are more easily handled than the circles; and the glass slides should be thick, and of the best quality, with ground edges.

The utmost care must be given to the technique of the process; and to the selection of the proper dyes for staining, many of the dyes on the market being worthless for this work. Excellent results may be expected from the employment of the dyes made by Grübler; although if thionin, to be referred to later, is used, it should be that made by E. Cogit et Cie, of Paris.

The part from which the blood is taken, either the tip of the finger, or the lobe of an ear, is to be cleaned first with soap and water, followed by alcohol and ether; and if a finger be the part selected, it is well to slip a folded towel behind it, and in front of the adjacent fingers, so as to isolate it from its neighbors. Cover-glasses, slides, and any instruments which may be needed in preparing the specimen for staining must be clean, sterile, and entirely free from dust; the presence of the latter will ruin the appearance of the "spread," and it is to be rigorously guarded against. After having removed the dirt and grease from the slides and cover-glasses, it is a good plan to keep them in covered receptacles, containing a mixture of equal parts of alcohol and ether, from which they may be removed and wiped dry with a bit of tissue paper when needed.

For making the "spread" two cover-glasses are needed. After having wiped away the first drop of blood following the puncture, which should be of sufficient depth to allow a single drop of blood to escape unaided by pressure on the part, a small portion of the next drop is allowed to fall on the centre of one of the cover-glasses which is immediately placed, blood side downward, upon the other, and the two gently pressed together between the fingers until the blood is seen to spread out toward the peripheries of both; the glasses are now rapidly drawn apart, each bearing a thin film of blood, and set aside to dry, carefully protected from dust. Great care and considerable practice are required to obtain a satisfactory "spread," which, in spite of the precaution of the operator, is apt to be too thick, and unevenly distributed; and it will save much time and inconvenience later, if all the cover glasses that do not show a thin, even film of blood are rejected at this stage of the process.

As soon as the blood on the cover-glasses is dry, they should be placed in a solution of equal parts of absolute alcohol and ether for half an hour, to fix the film of blood, and to harden it; or, if a more rapid fixing is desired, a ten per cent. solution of formalin, which will fix the blood in five minutes' time, may be used.

From the large number of stains used, perhaps the most useful for general purposes, and one from which uniformly good results may be obtained, is a combination of eosin and methylene-blue made according to the following formula:

Saturated aqueous solution methylene-blue 3 ounces
Absolute alcohol . . . . . 8 drops
Eosin, to which sufficient distilled water has been added for solution, ... 7½ grains

After the "spread" cover-glasses have been in the alcohol and ether mixture a sufficient length of time, they are dried in air; and then grasped, "spread" side uppermost, with forceps, and flooded with the stain; gently heated over the flame of an alcohol lamp, or Bunsen burner, for the fraction of a minute; allowed to stain without heat for from one to three minutes longer; and then thoroughly washed in distilled water; dried in air; and mounted in cedar-oil balsam, if a permanent specimen is

desired, or in water, if the slide is not to be kept.

Another method of using eosin and methylene-blue, slower than the former, but giving beautiful results, is to stain without heat for about five minutes in a one-half per cent. solution of eosin in absolute alcohol to which an equal quantity of distilled water is added before using; wash in distilled water; dry in air; stain for one minute or less in a saturated aqueous solution of methylene-blue; again wash in distilled water; dry in air; and mount in balsam, or in water.

Of these two methods the former is to be chosen in most instances, on account of its simplicity and rapidity. In the specimen stained by either method the erythrocytes are colored red; the nuclei, blue; the eosinophiles, a brilliant crimson; and most parasites that may be present, blue.

For staining the neutrophilic granules of the leucocytes, Ehrlich's Tri-acid Stain is usually recommended, although with this mixture good results are more difficult to obtain than with eosin and methylene-blue, its chief deficiency seeming to lie in its unsatisfactory differentiation of the nuclei. The Tri-acid mixture contains orange G., methyl-green, and acid fuchsin, and is put up in bulk by Grübler after Ehrlich's formula, and sold by dealers in bacteriological supplies. The preparations are stained in this solution for several hours; rinsed in distilled water; dried in air; and mounted in cedar-oil balsam. They should show, if successful, the neutrophilic granules stained lilac; the eosinophiles, red; the nuclei, green; and the erythrocytes, orange red.

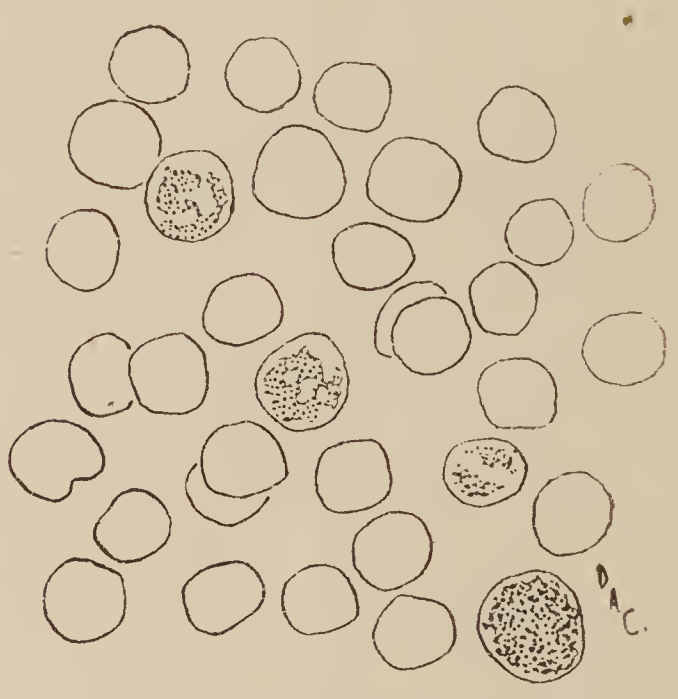
If the blood is to be stained on the slide, instead of on the cover-glass, Waldstein's "smearing-slip" is of great service for obtaining a good "spread." It consists of a slip of crown glass, measuring 3 x ½ x ⅛ inches, with perfectly smooth and rounded edges. After a small drop of blood has been allowed to run along one edge of the slip, it is placed at an acute angle on the slide, and quickly drawn over its surface, gentle, even pressure being exerted. The slide may then be treated as in the methods given for cover-glass preparations.

While for the purposes of diagnosis the parasites of malarial fever should be studied in the fresh, unstained blood, taken from the patient just before the onset of the paroxysm, these bodies may be well stained by the eosin-methylene-blue solutions above referred to; or, instead, as recommended by v. Jaksch, Plehn's Solution may be employed; it is made as follows:

½ per cent. solution eosin in 75 per cent. alcohol	20 c. c.
Concentrated watery solution methylene-blue	60 "
Distilled water	40 "
20 per cent. solution caustic potash	12 drops

Thionin is also an excellent stain for this organism, imparting to it a blue color, which contrasts well with the pale green hue which the erythrocytes take from this dye. The following solution of thionin, in which the blood is to be stained for about ten minutes, has been successfully used by the writer:

Thionin (Cogit's)	.5 grms.
25 per cent. solution carbolic acid	1. cc.
95 per cent. alcohol	10. cc.
Distilled water	90. cc.



THE BLOOD IN MALARIA.

(From a case of Tertian Intermittent Fever in the Jefferson Medical College Hospital.)

The bacilli of tuberculosis are very rarely found in the blood, but in acute miliary tuberculosis small numbers may be detected occasionally, by the method employed in sputum-staining, which stains them red. The specimen is gently heated for from one to three minutes in the Neelsen-Ziehl carbol-fuchsin solution; rinsed in distilled water; counter-stained and decolorized in Gabbet's acid methylene-blue; thoroughly washed in distilled water; dried; and mounted in Canada balsam. The formulæ for these solutions are:

Neelsen-Ziehl Carbol-Fuchsin

Fuchsin	1 grm.
95 per cent. alcohol	10 cc.
5 per cent. aqueous solution carbolic acid	100 cc.

Gabbet's Acid Methylene-blue

Methylene-blue	1 grm.
25 per cent aqueous solution sulphuric acid	100 cc.

Other micro-organisms, found in the blood in certain diseases, such as anthrax bacilli, spirilla of relapsing fever, and streptococci, are best stained by concentrated aqueous solutions of the basic anilin dyes; gentian violet, and methylene-blue may be chosen as good examples of such agents. The prepared cover-glasses are treated with the stain for from one to five minutes; washed with

distilled water; dried in air; and mounted in balsam, or in water. In dealing with all micro-organisms, attention must be given to antisepsis, as well as to cleanliness, and this must be secured by the use of a good antiseptic, such as a 1-1000 solution of bichloride of mercury, for washing cover-glasses, slides, and the part from which the blood is taken, and by the sterilization of instruments by heat.

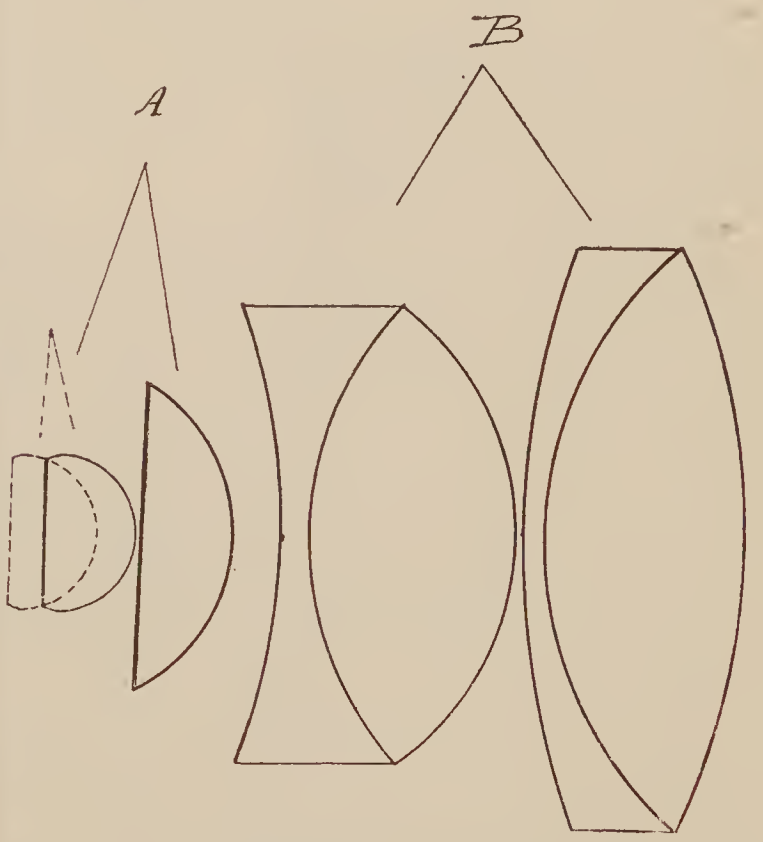
In conclusion, it may be remarked that success in blood-staining, which varies so greatly in different samples of blood subjected to precisely similar methods, may be only obtained by constant experiment, and by repetition of technique; and that each worker in this subject must determine for himself certain points concerning which no specific directions can be given. Care taken to filter all stains before using; to use in staining but a slight degree of heat—just sufficient to gently warm the staining fluid; to thoroughly wash away with distilled water all traces of the stain; and to avoid dust during the whole procedure; all these precautions will contribute towards obtaining a good slide.

[For The Microscopical Bulletin.]

THE CONSTRUCTION OF HIGH-GRADE OBJECTIVES.

BY HENRY ORFORD, PHILADELPHIA.

The accuracy of workmanship necessary for the perfect performance of a high-class microscope objective, fully equals in value, as to the ultimate result, the computation; for be that ever so perfect, faulty work, be it in the grinding, polishing, edging and centering even in a very slight degree renders the formula useless. A description of methods used in making our new $\frac{1}{12}$ may be interesting. This lens is composed of four systems—two pairs of lenses and two single lenses. The glass is of flint and crown, ranging in density from 2.3 to 4.1, carefully chosen so there is not the slightest chance of decomposition. The pieces of glass, after being carefully weighed and the exact specific gravity taken, are fixed on to holders. These are brass chucks which screw on to the lathe, and the lenses are turned up to curve with a graver or a diamond point; then ground and polished to the necessary curvature. All this needs care, but great skill comes in when polishing; for on this depends the perfection of the image. The simplest way for getting perfect curvature is by trial with Newton's rings; that is, by making a glass or quartz plate, in which are ground and polished accurately, the opposite curves to those used; and then by constant trial of the test and the lens, working until the colors are evenly distributed all over the two surfaces. These can be made to fit so closely that it is impossible to get them apart by pulling, and gentle heat is required for their separation. The most difficult surface in the system is the front, this being hyper-hemispherical, considerable skill is required to get the perfect curve wanted, for it takes but an instant of inattention to turn the spherical curve into a parabola, and its worth has gone. Not only in curvature, but in substance and diameter is the same accuracy required. For instance, the thickness in the centre of the two flints is .003 and .004 respectively; alter either of them .001 and the corrections are altered. The lenses being worked, they must now be centered and a perfectly true edge put on. This is done on a hollow chuck which has a vent in it to allow the escape of the hot air, and a true edge put on by turning very carefully. The lenses are fastened to the edging chuck by hard balsam, and held in position by a small peg of special wood, until the images reflected by the surfaces are perfectly still though the lens itself is revolving. The pairs of lenses are then put together by balsam which is gently heated until perfectly hard, and the system is ready for the setting. Here again to get the results now required, the workman must be most accurate in his methods; the threads of the cells must fit perfectly; the shoulders must be square and true, and the tapers at the backs cut right up to the lenses, or the aperture is lost. These four lenses are



mounted in four different cells, and the two pairs comprise one part of the system and are screwed together, and the two singles the other. These lenses being set up true, are ready for adjusting. Herein lies the making of image and the slight alteration of distance that will make a lens good or bad is almost incredible. The system is thus: the two pairs of lenses that are screwed to-

gether, are enormously over-corrected and the two single lenses being uncorrected in themselves, though together partially achromatic, being approximately the principle of the Huyghens eyepiece. These two parts of the objectives have to be so placed that the emergent rays from the objective are confined to certain colors, all others in their passage through the system being corrected; and it is only when they are absolutely destroyed that we may expect to get a critical image. Here the difference of .0001 of an inch either too close or too far off will make the lens perform or not, for the posterior system will not catch the emergent pencils that have passed through the front system at the proper point, thereby letting some colored rays through that are fatal to the image being formed. The diagram will make it easy to see the system of our homogeneous $\frac{1}{12}$ and where the adjustment lies between a and b. Also any alteration of distance between the two singles as shown by a dotted front further away must lead to loss of aperture and consequently loss of light.

[For The Microscopical Bulletin.]

A NEW OBJECTIVE BY MESSRS. QUEEN & COMPANY.

DR. ALFRED C. STOKES, TRENTON, N. J.

It was with pleasure that I learned from the firm that the Messrs. Queen had begun the manufacture of microscope objectives, and with much greater pleasure that I acceded to their request to examine one of the new $\frac{1}{12}$ lenses, from what they have named their Bacteriological Series. The lens is homogeneous immersion, non-adjustable and has an angle of 1.35 N. A.

For an objective of this aperture to resolve *Amphipleura pellucida* in balsam is no feat; the surprise would be great if it should not do so. In this instance nothing is required for the purpose except ordinary oblique light from the mirror. With oblique illumination, however, from the achromatic condenser, the $\frac{1}{12}$ resolves *Surirella* in styrax into black dots, a performance more commendable and interesting, perhaps, than the resolving of *Amphipleura*. With central light from the achromatic condenser, and illuminating rather less than one-third of the back lens, the objective resolves the same *Surirella* into beads with the compensating two-inch ocular; under oblique light from the mirror, with the hemispherical lens attached to the slide, the same diatom is resolved into undulating longitudinal striæ. With central light from the condenser, under somewhat less than a one-third illuminating cone, *Isthmia nervosa* exhibits its secondary structure with good resolution of the postage stamp fracture through those secondaries. This is not an easy test for any but the widest angled objectives. The secondary structure of *Isthmia enervis* is resolved in balsam rather imperfectly; in Piffard's medium (1.625 refractive index), the performance of the lens is much improved, and the postage stamp fracture resolved.

A postage stamp fissure through the secondary membrane of this diatom is considered a severe test for any objective; the lens that responds in an entirely satisfactory way is one to be treasured.

But the Messrs. Queen have not designed their new $\frac{1}{12}$ to have especially great and brilliant resolving power, caring rather to make it, as they say, "a rapid working lens for the practicing physician." With its remarkably flat field and its ample working distance, the lens should be welcomed by those whose purpose does not call for deep eyepiecing, nor for the highest resolving power in the objectives used for rapid examination and diagnosis.

The minute fissure in the so called spiral fibre of insect tracheæ is hardly a histological subject for the practicing physician, but it is a rather severe test for an objective. The new $\frac{1}{12}$ exhibits it distinctly with the compensating two-inch eyepiece. The ultimate muscular fibril is perhaps a more congenial object, and is more of a test than is commonly supposed. The new $\frac{1}{12}$ displays it well; and the *Bacillus tuberculosis* in its sporuliferous state is not a troublesome subject for it.

There is one feature however in which the lens is open to condemnation, a character which it has in common with Reichert's famous $\frac{1}{12}$. The front lens is not flush with the mounting, as it should be. Spencer's superb work is a model in this respect; with it the microscopist never has any of the exasperating annoyance which he will surely have with the Reichert and with the Queen, and with any other high power objective so mounted. Four times in succession have I applied the oil and focussed the objective, and four exasperating times in succession have I caught a bubble in that little depression in the mounting, and been compelled to remove the lens, clean it and the slide and to re-focus, only to repeat the same unnecessary experience. Any microscopist capable of using such an objective as this $\frac{1}{75}$ by the Messrs. Queen, could be trusted with it were the front lens flush with the mounting, as it should be. If the artist who made the objective can remove this source of annoyance, which will not rarely militate against its rapid use, he will facilitate its employment by the busy physician and by the student of histology for whom it is intended.

[We are informed by Messrs. Queen & Co. that in making up the first lot of these 1-12 in. objectives, several forms of mounting were used for experimental purposes. In only *one* of the objectives was the front lens set back from the surface as is customary with the Continental makers, and this particular one is described in Dr. Stokes' article. This point will be observed in the future manufacture of the objective. Ed.]

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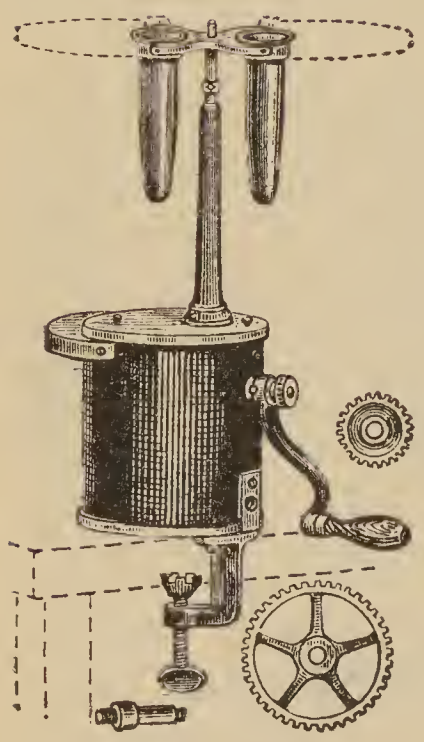

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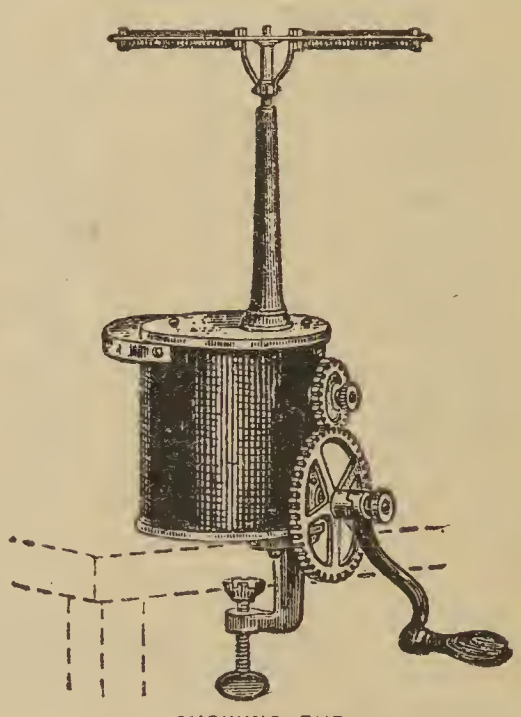

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